EXHIBIT A
WORK STATEMENT

GLOSSARY
Specific terms and acronyms used throughout this work statement are defined as follows:

Acronym	*Definition*
CPR	*Critical Project Review*
DUIT	*Distributed Utility Integration Test*
DAS	*Data Acquisition System*
DER	*Distributed Energy Resources (generation and storage)*
MGTF	*Modular Generation Test Facility*
kW	*Kilo-watt*
kWh	*Kilo-watt Hour*
kV	*Kilo-volt*
Rule 21 Workgroup	*Rule 21 Interconnection Working Group*
V	*Volt*

Problem Statement
The increasing potential of distributed resources in emerging utility markets has focused attention on two critical issues: interconnection of distributed resources with the electric distribution system, and the unknown nature of potential interactions between multiple distributed devices. Interconnection is a critical issue because of the diversity of distributed technologies and the variability of interconnection standards and practices from state to state and utility to utility. The other critical issue is the potential for interactions between distributed resources in close proximity within a distribution system is not known, simply because not enough operating experience has been gained to date.

This Distributed Utility Integration Test (DUIT) is the next step in assuring the safe, reliable, secure and cost-effective inclusion of distributed resources into the electric systems of the future. By collaborating with our proposing team, the Commission will advance the state of the art of distributed resources integration and strengthen its leadership role in distributed power.

By examining current and emerging technologies and operational concepts to properly integrate diverse distributed resources, this project will give new insights into grid support issues and ultimately suggest innovative system protection design concepts.

In particular the DUIT will illuminate the following issues:
- Universal distributed and electric power system interconnection technology including current and advanced/future designs; requirements and tests for safe and effective interconnection;
- Interconnection equipment performance and functional characterization and installation test method design, development, validation and documentation;
- Interconnection equipment/technology body of tests issues and procedure.

Goals and Objectives

The goal of this project is to determine what impact large numbers of DER will have on the electrical distribution system.

This project meets the PIER Goal of Improving the Reliability/Quality of California's Electricity.

The objectives of this project are to: prove the feasibility and the integration of diverse distributed generation and storage technologies in a distribution system; and provide a testing ground for observing and measuring the interactions between the distributed technologies on the distribution system. Achieving these objectives requires a project that will entail full-scale implementation testing and demonstration of distributed generation technologies in an actual utility installation.

TASK 1: PROJECT START-UP

Subtask 1.1 Attend Kick off Meeting

The objective of this task is to identify procedures for communication and reporting project status during the contract.

The Contractor shall:

- Attend a "kick off" meeting with the Commission Contract Manager and the Contracts Officer. The technical and administrative aspects of contact startup will be discussed at the meeting. Prior to the kick off meeting, the Commission Contract Manager will provide an agenda to all potential meeting participants.

  The administrative portion of the meeting shall include, but not be limited to, the following:
  - Terms and conditions of the contract;
    - Roles and responsibilities of both parties
    - Budget changes
    - UCC.1 form filing
    - Invoicing
    - Prior approvals for travel and equipment
    - Confidential deliverables
    - Intellectual property
  - Match fund documentation (Subtask 1.2)
  - Permit documentation (Subtask 1.3)

  The technical portion of the meeting shall include, but not be limited to, the following:
  - The Commission Contract Manager's expectations for accomplishing tasks described in the Work Statement;
  - An updated schedule of deliverables (Exhibit B)
  - An updated Gantt chart
  - Progress reports

- Technical deliverables
- Final report

The Commission Contract Manager shall designate the location of this meeting.

Deliverables:
- Attend kick-off meeting
- An Updated Schedule of Deliverables
- An Updated Gantt Chart

Key Personnel:
Bill Erdman

Key Subcontractors:
Chuck Whitaker, Endecon Engineering; Manny D'Albora, Pacific Gas & Electric

Subtask 1.2 Document Matching Funds
The goal of this task is to document the match funds for this contract.

- The Contractor need not resubmit match fund documentation if it was provided in the Contractor's proposal and the information submitted is still valid. The Contractor, however, shall assist the Commission Contract Manager to locate this proposal information, upon request.
- In the event match fund sources change during the contract term, Contractor shall immediately notify the Commission Contract Manager for approval.

Documentation of match fund commitments shall be received, reviewed and approved in writing by the Commission Contract Manager before any PIER funds under this contract are disbursed and PIER-funded work on technical tasks may begin.

The Contractor shall:

Provide the following information about the match funding to be used to conduct this project:

1. Amount and source of each cash match funding, including a contact name, address and telephone number.

2. Description, documented market or book value, and source of each in-kind contribution, including a contact name, address and telephone number.

   If the in-kind contribution is equipment or other tangible or real property, Contractor shall identify its owner and provide a contact name, address and telephone number, and the address where the property is located.

3. Written commitment from each source of cash match funding or in-kind contributions that these funds or contributions have been secured or will be secured prior to the date(s) when the funds or in-kind contributions are required for project expenditures.

4. If there are no match funds at the start of the contract, then state such in the letter.

In the event the Contractor has not provided the written match fund commitments for this project by three months after the contract execution date, the Commission may, at its option and in its unfettered discretion, terminate this contract by advising Contractor in writing that the contract will be terminated in thirty (30) calendar days.

Deliverables:
- Letter and documentation confirming matching fund sources.
- Documentation of changes as they occur during the contract term.

Key Personnel:
None

Key Subcontractor:
None

Task 1.3 Identify and Obtain Required Permits
The goal of this task is to obtain all permits required for work completed under this contract in advance of the date they are needed to keep the project schedule on track.

The Contractor shall:
- If no permits are required to conduct this project, the Contractor shall state this finding in writing to the Commission Contract Manager.

- Provide the following information about permits required for this project:
  - Type of permit
  - Name, address and telephone number of the permitting jurisdictions or lead agencies
  - Schedule the Contractor will follow in applying for and obtaining these permits
  - A copy of each approved permit

- Submit this information to the Commission Contract Manager at the kick-off meeting. The schedule for obtaining permit(s) will be discussed at the kick-off meeting, and a timetable for submitting the updated lists and the copies of the permit(s) will be developed.

- In all cases, permits must be identified in writing and obtained before any costs related to the use of the permit(s) are incurred for which PIER reimbursement will be requested under this contract.

- Permit expenses are not reimbursable through the contract; therefore, the PIER budget for this task will be zero dollars.

Deliverables:

- A statement that no permits are required or
- A list of all permits required for this project
- Updated list of permits as they change during the contract term
- A copy of each approved permit.

Key Personnel:
None

Key Subcontractor:
None

TASK 2.0 TECHNICAL TASKS

The project's work scope involves the following technical tasks:

Task 2.1 DER Procurement Process
Task 2.2 Test Plan Development
Task 2.3 Test Management Control System Specification Development
Task 2.4 Data Acquisition System Design
Task 2.5 Test Management Control System Software Development
Task 2.6 Test Facility Engineering and Hardware Procurement
Task 2.7 DER Installation and Acceptance Testing
Task 2.8 DAS and Control System Installation
Task 2.9 Systems and Subsystems Commissioning Testing
Task 2.10 Modeling and Analysis
Task 2.11 Distributed Utility Integration Testing

Critical Project Reviews

Critical Project Reviews shall take place at key points in this contract. These generally occur at predetermined points to see if the overall contract goal is being achieved. The Commission will conduct Critical Project Reviews during or at the conclusion of the following tasks:

Task 2.2.6 Test Plan Development
Task 2.6.3 Test Facility Engineering and Hardware Procurement

Critical Project Reviews are meetings between the Contractor, the Commission Contract Manager and other individuals selected by the Commission Contract Manager to provide objective, technical support to the Commission. Meeting participants may include PIER Program Team Lead, Contracts Officer, Commission Technical Staff and Management. The purpose of these meetings is to discuss with the Contractor the status of the contract and its progress toward achieving its goals and objectives. These meetings may take place either at the Commission Office in Sacramento, or at another reasonable location determined by the Commission Contract Manager and the Contractor.

Before each Critical Project Review meeting, the Contractor shall provide the relevant task deliverable(s) to the Commission Contract Manager and any other designated reviewers sufficiently in advance to permit review of the deliverable document(s) before the review meeting. If not already defined in the Work Statement, the Commission Contract Manager shall specify the contents of the deliverable document(s).

At the Critical Project Review meeting, the Contractor shall present the required technical information and participate in a discussion about the contract with the Commission Contract Manager and other meeting attendees, if any.

Following the Critical Project Review meeting, the Commission Contract Manager will determine whether the Contractor is complying satisfactorily with the Work Statement and

whether the contract is demonstrating sufficient progress toward achieving its goals and objectives to warrant continued PIER financial support for the contract.

As an outcome of each Critical Project Review, the Commission Contract Manager will provide a written response within 10 working days to the Contractor indicating his or her conclusions about the contract to date. The written response may include a requirement for the Contractor to revise one or more deliverables that were included in the Critical Project Review. After each review, the Commission Contract Manager may reassess and reallocate the tasks, schedule, deliverables and budget for the remainder of the work including not proceeding with one or more tasks.

If the Commission Contract Manager concludes that satisfactory progress is not being made, this conclusion will be referred to the Commission's Research, Development and Demonstration Policy Committee for its concurrence.

Technical Task Descriptions

Task 2.1 DER Procurement Process
The goal of this task is to develop and implement a procurement process for vendors and suppliers of the DER equipment that will be tested. It is expected that many of the DER can be leased or rented. In this task, it will be determined what is capable of being borrowed, leased or rented, and what needs to be purchased. The scheduling data will then be used in coordination with the Test Plan (Task 2.2).

Successful completion of this task will be measured by obtainment of the DER equipment necessary to support the test activities with the majority of the equipment being leased or rented so as to meet the DER technologies budget. Furthermore, obtaining the DER systems on a time frame which achieves a coordinated schedule that minimizes dead time between tests but ensures applicable tests with DER technologies are completed.

Meeting this goal helps to achieve the project objectives by ensuring that the DER technologies are available for specific tests and to ensure that a diversity of DER types and sizes are evaluated for potential grid impacts.

The Contractor shall:

2.1.1 Determine what types of commercial DER systems shall be included in the test program. Prepare a draft DER Test List which shall include commercially available generation and storage technologies. It shall also include a mixture of inverter, synchronous and induction based generation technologies as applicable.

2.1.2 Submit the draft DER Test List to the Commission Contract Manager for review and approval. The final DER Test List shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the final DER Test List. Key elements from the DER Test List shall be included in the Final Report for this project.

2.1.3 Determine the availability of approved technologies for lease, rent, loan or purchase. The costs for each technology shall also be determined.
2.1.4 Prepare a draft Procurement Process Report that includes an optimized, coordinated schedule that minimizes rental or lease expenses by utilizing loaned equipment.
2.1.5 Submit the draft Procurement Process Report to the Commission Contract Manager for review and approval. The final Procurement Process Report shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the final Procurement Process Report. Key elements from the Procurement Process Report shall be included in the Final Report for this project.

Deliverables:
- Draft DER Test List
- Final DER Test List
- Draft Procurement Process Report
- Final Procurement Process Report

Key Personnel:
None

Key Subcontractors:
None

Task 2.2 Test Plan Development
The goal of this task is to establish an efficient optimal Test Plan and schedule. Working from the project test protocols developed in 2001, document titled "Distributed Utility Integration Test Protocol", this task will overlay the prioritized protocols with the scheduling and availability of DER hardware, fuel needs, maintenance, and other operational factors. The test protocol document is currently organized based on an initial prioritization of a limited group of technical reviewers. Anti-islanding and voltage regulation testing groups were identified as the two most pressing issues. In this task, a more detailed definition of order and precedence of the protocol groups, as well as, tests within the groups would take place. This prioritization process would be open and would solicit input from key stakeholders including members of the Rule 21 Workgroup.

Successful completion of this task will be measured by the development of an efficient, effective Test Plan which supports the prioritized needs of key stakeholders and is consistent with the availability of DER technologies and facilities upgrading.

Meeting this goal helps to achieve the project objectives by obtaining the optimal amount of prioritized testing with the given resources and schedules.

The Contractor shall:

2.2.1 Develop a Draft Test Plan. The basis for the Draft Test Plan shall be the test protocols (see Department of Energy Contract #NREL-AAD-0-30605-05) developed in 2001 under contract with the Department of Energy, Office of Power Technologies. The plan shall

include information about equipment availability and cost determined in Task 2.1. It shall detail the definition of order and precedence of the test protocol groups, as well as, tests within the groups. It shall also include, but not be limited to:

- A description of the process to be tested
- The rationale for why the tests are required
- Predicted performance based on calculations or other analyses
- Test objectives and technical approach
- A test matrix showing the number of test conditions and replicated runs
- A description of the facilities, equipment, instrumentation required to conduct the tests
- A description of test procedures, including parameters to be controlled and how they will be controlled; parameters to be measured and instrumentation to measure them; calibration procedures to be used; recommended calibration interval; and maintenance of the test log
- A description of the data analysis procedures
- A description of quality assurance procedures
- Contingency measures to be considered if the test objectives are not met
- DER capital and installation costs
- DER operating and maintenance costs as well as operating manpower
- Fuel consumption, fuel cost, and fuel availability
- Development of an operations log that includes but is not limited to: annual capacity factor, annual kWh produced, plant annual kWh consumed
- Schedule and installation plans for conducting the tests on different DER equipment
- Acceptance tests to be conducted upon delivery on DER equipment to test facility (the acceptance tests shall consider recommendations from manufacturer on needed acceptance testing)
- Commission test to be conducted for initial DER units installed prior to formal start of DER Integration Testing

2.2.2 Submit the Draft Test Plan to the Commission Contract Manager for review and approval. A Revised Draft Test Plan shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of this Test Plan.

2.2.3 Coordinate presenting the Revised Draft Test Plan to the Rule 21 Workgroup. Key stakeholders from this group shall be asked to provide comment on the Revised Draft Test Plan.

2.2.4 Compile the comments received from the Rule 21 Workgroup and submit them to the Commission Contract Manager for review and comment. The Commission Contract Manager shall provide comments to the Contractor within 5 working days of receipt of the Rule 21 Workgroup comments. The Contractor shall revise the Revised Draft Test Plan to incorporate the Rule 21 Workgroup's comments as appropriate and develop the Draft Final Test Plan.

2.2.5 Submit the Draft Final Test Plan to the Commission Contract Manager 15 days prior to the first Critical Project Review. This document will be one of the main topics for discussion at the Critical Project Review.
2.2.6 Participate in the first Critical Project Review.
2.2.7 Modify this Draft Final Test Plan in accordance with comments received during the Critical Project Review. The Final Test Plan shall be submitted to the Commission Contract Manager within 10 working days after the Critical Project Review. The Commission Contract Manager shall send written notification of approval to the Contractor within 5 working days after receipt. Key elements from this document shall be included in the Final Report for this project.
2.2.8 Revise Test Plan per testing in task 2.11 and per modeling and simulation in task 2.10. Revisions will be made as dictated from results in these tasks.

Deliverables:
- Draft Test Plan
- Revised Draft Test Plan
- Compilation of Rule 21 Workgroup's Comments
- Draft Final Test Plan
- Final Test Plan

Key Personnel:
Bill Erdman

Key Subcontractors:
None

Task 2.3 Test Management Control System Specification Development
The goal of this task is to develop specifications for a test management control system to be used with DER technologies and test loads at the MGTF. The specification shall largely represent hardware and software that is capable of aggregating and dispatching DER. Many tests require autonomous control of multiple DER while other tests require aggregated control. Closed loop control of independent DER within an aggregation shall be included in the design so that aggregated operation is smooth and stable. Remote dispatching of multiple DER independently and in aggregation shall be designed into the test management control system.

Successful completion of this task will be measured by completion of the specification on schedule, as set forth in the current Exhibit B, so that it can be handed off to project hardware and software developers. The installation and commissioning of the test management control system is required before any testing can occur.

Meeting this goal helps to achieve the project objectives by allowing the completion of the control system infrastructure in time for the testing to occur. The aggregation piece of the control system will permit testing, but also, demonstration of aggregated DER.

The Contractor shall:

2.3.1 Develop a Draft Test Management Control System Specification. The specification shall enable the following capabilities from the test management control system:

- The test management control system shall be designed to facilitate and perform the Test Plan at 480V as well as capability to test up to 21kV.
- The hardware and software shall be capable of aggregating and dispatching multiple DERs simultaneously.
- The software shall be capable of autonomous control of DER and aggregated control.
- Additionally, remote dispatching of DER independently and in aggregation shall be designed into the control system.
- Important validation of the concept of monitoring and control needs shall be incorporated into the specification.
- Specification shall emphasize controls and data collection so that the evaluation of benefits related to intentional islanding can be determined.
- The software and hardware shall have closed loop feedback of independent DER within an aggregation so that aggregated operation is smooth and stable.
- Other issues that the specification should include are:
  - How data should be processed
  - How much data can/should be used to communicate and control
  - Which/how much data operators need for aggregation and dispatch
  - What control variable are most important

2.3.2 Submit the Draft Test Management Control System Specification to the Commission Contract Manager for review and approval. The Final Test Management Control System Specification shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Test Management Control System Specification. Key elements from the Final Test Management Control System Specification shall be included in the Final Report for this project.

Deliverables:

- Draft Test Management Control System Specification
- Final Test Management Control System Specification

Key Personnel:
Bill Erdman

Key Subcontractors:
None

Task 2.4 Data Acquisition System Design

The goal of this task is to complete the hardware and software design of the DAS infrastructure for the MGTF. The DAS infrastructure is that portion of the DAS hardware and software that remains unchanged from test to test. Since the DAS is unique in its high speed, number of data

collection points, and relatively long distances, and it represents a significant cost item in the Test Plan, it is necessary to correlate the DAS into phases consistent with the test and facility subdivision. The DAS and test management control system will be co-located and executed from the same hardware.

Successful completion of this task will be measured by meeting the delivery date of the documentation package, as set forth in the current Exhibit B, which includes the software and hardware necessary for DAS implementation.

Meeting this goal helps to achieve the project objectives by putting the test DAS into place and confirming its operation in time to support DER testing. The combination DAS and test management control system is unique in its ability to record high speed data and in the ability to control and dispatch aggregated DER.

The Contractor shall:

2.4.1 Develop the Draft DAS Design Document. The hardware design shall include engineering layout drawings of the signal cable routing, data collection points, hardware selection, and data storage locations for the low voltage testing. The DAS functions shall include, but is not limited to, low level code which causes D/A and A/D converter to communicate with computers, and signal synchronization.

2.4.2 Submit the Draft DAS Design Document to the Commission Contract Manager for review and approval. The Final DAS Design Document shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final DAS Design Document. Key elements from the Final DAS Design Document shall be included in the Final Report for this project.

Deliverables:
- Draft DAS Design Document
- Final DAS Design Document

Key Personnel:
Bill Erdman

Key Subcontractors:
Chuck Whitaker, Endecon Engineering

Task 2.5 Test Management Control System Software Development
The goal of this task is to develop the software necessary for the control portion of the combined DAS/test management control system software. The DER integration testing requires a unique test management control system of which a portion is integrated into the DAS computer hardware and software.

Successful completion of this task will be measured by meeting the scheduled delivery date, as set forth in the current Exhibit B, so as to support overall DER testing requirements.

Meeting this goal helps to achieve the project objectives by providing the necessary control system to execute autonomous and aggregated control of the DER's used in testing.

The Contractor shall:

2.5.1 Develop the software necessary to control the test management control system hardware in accordance with the specification developed in Task 2.3. Appropriate portions of the software shall be integrated into the DAS computer hardware and software. Notification of progress and percentage of completion of this task will be included in the Monthly Progress Report.

Deliverables:

- Notification of Progress and Percentage of Completion (shall be included in Monthly Progress Reports)

Key Personnel:
Bill Erdman

Key Subcontractors:
None

Task 2.6 Test Facility Engineering and Hardware Procurement
The goal of this task is to perform the engineering necessary to prepare the facility for the testing. Under this task, all pre-installation and facility preparation engineering will be performed. This includes development of construction drawings and procurement lists for testing hardware, equipment and materials. Additionally, initial hardware will be procured. Only that hardware to be used in the early phases of the testing will be procured at this time.

Successful completion of this task will be measured by meeting the scheduled facility readiness dates, as set forth in the current Exhibit B, to support DER testing. A design review is scheduled at the end of this task which will serve to assure the readiness of the facility.

Meeting this goal helps to achieve the project objectives by providing a site ready to accept the DAS/test management control system and DER's, which will allow for timely execution of tests.

The Contractor shall:

2.6.1 Prepare a Draft Facility Engineering Report. The report shall identify the modifications needed to the MGTF in order to conduct the testing specified in the Test Plan. The modifications identified shall include those needed to enable 480V testing at the MGTF as well as begin the preparation for DER Integration Testing at distribution voltages up to 21kV. The facility shall meet the following testing minimums:

- 3 DER sites, each consisting of one larger unit, or several smaller units
- Total combined generation up to 500kW
- Maximum single unit generation of 150kW
- Variable resistive, reactive, and capacitive loads at each DER site

- 480V radial distribution
- Total simulated impedance of 30 miles, in 10 mile steps

Develop line diagrams for the selected technologies, instrumentation and control, monitoring equipment and test facility layout. Photographs of the existing facilities and proposed testing locations can be included, if necessary.

Develop a list of equipment and materials that must be procured to allow the facility to conduct the testing specified in the Test Plan. The list shall include costs.

Determine what modifications would be needed to enable the testing facility to conduct 21kV distribution system testing. Equipment and material needs, costs, and line diagrams shall be included.

2.6.2 Submit the Draft Facility Engineering Report to the Commission Contract Manager for review at least 15 working days prior to the second Critical Project Review. The Draft Facility Engineering Report will be one of the main topics for discussion at the Critical Project Review.

2.6.3 Participate in the second Critical Project Review.

2.6.4 Modify the Draft Facility Engineering Report in accordance with comments received during the Critical Project Review. The Final Facility Engineering Report shall be submitted to the Commission Contract Manager within 10 working days after the Critical Project Review. The Commission Contract Manager shall send written notification of approval to the Contractor within 5 working days after receipt. Key elements from this document shall be included in the Final Report for this project.

2.6.5 Procure the testing hardware for the DAS and test management control system, and other facility materials and equipment as specified in the Final Facility Engineering Report, DAS Design Document and Test Management Control System Specification.

2.6.6 Make the necessary test facility modifications in accordance with requirements specified in the Final Facility Engineering Report, DAS Design Document and Test Management Control System Specification.

Deliverables:
- Draft Facility Engineering Report
- Final Facility Engineering Report

Key Personnel:
None

Key Subcontractors:
Manny D'Albora, Pacific Gas & Electric

Task 2.7 DER Installation and Acceptance Testing
The goal of this task is to install the initial DER to be tested and conduct acceptance testing of the DER. The acceptance testing shall verify that the DER equipment performs as specified by the equipment manufacturers and as required by the Test Plan.

Successful completion of this task will be measured performance and acceptance of the various DER sources. Completion will assure that the project has adequate, diverse DER for testing.

Meeting this goal helps to achieve the project objectives by providing diverse, functional DER ready to support the DER testing.

The Contractor shall:

2.7.1 Procure the initial DER to be tested as specified in DER Procurement Process, Task 2.1, and Test Plan, Task 2.2.
2.7.2 Install the DER into the MGTF in accordance with the Test Plan.
2.7.3 Conduct acceptance testing of the individual DER equipment in accordance with the Test Plan.
2.7.4 Develop a Draft Monthly Acceptance Testing Summary. Submit this Draft to the Commission Contract Manager for review and approval. The Final Monthly Acceptance Testing Summary shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Monthly Acceptance Testing Summary. Once DER procurement and acceptance testing has begun, the Monthly Acceptance Testing Summaries shall be submitted with the Monthly Progress Reports specified in Task 3.1. The summary shall include, but is not limited to, the following:
    - Specific DER equipment that was acceptance tested
    - What specific acceptance tests per specific DER equipment were conducted
    - A matrix of what tests passed and failed
    - Corrective actions that were taken to address failed tests
    - Whether retests were required to pass acceptance tests

Deliverables:
- Draft Monthly Acceptance Testing Summary
- Final Monthly Acceptance Testing Summary
- Monthly Acceptance Testing Summaries (shall be included in Monthly Progress Reports)

Key Personnel:
None

Key Subcontractors:
Manny D'Albora, Pacific Gas & Electric

Task 2.8 DAS and Test Management Control System Installation
The goal of this task is to install the DAS and test management control system in coordination with the installation of each new piece of DER equipment.

Successful completion of this task will be measured by on time delivery of a fully functional, installed and operating DAS and test management control system, as set forth in the Test Plan.

Meeting this goal helps to achieve the project objectives by supporting the need for data acquisition and control during the DER integration testing.

The Contractor shall:

2.8.1 Install control devices for each individual DER, after successful acceptance testing. DAS and test management control system sensors and monitors shall also be installed. Sensors and monitors shall be interconnected to the respective locations in the DAS and test management control system. These activities shall be repeated for each new DER device as it is delivered for testing in compliance with the Procurement Process and Test Plan. The status of these installations shall be included in the Monthly Progress Reports.

Deliverables:

- Installation Status, DAS, Test Management Control System and DER (will be included in the Monthly Acceptance Testing Summaries, Task 2.7)

Key Personnel:
Bill Erdman

Key Subcontractors:
Chuck Whitaker, Endecon Engineering

Task 2.9 Systems and Subsystems Commissioning Testing
The goal of this task is to test the operation of the initial DER devices, DAS and test management control systems when all subsystems are integrated together.

Successful completion of this task will be measured by an on-schedule finish of the commissioning tests, in accordance with the Test Plan in Task 2.2, which demonstrates full functionality and the readiness to proceed with tests.

Meeting this goal helps to achieve the project objectives by demonstrating the readiness of all necessary subsystems operating together in an integrated complete system. At the completion of this task, the system and facility will be considered ready for DER testing, as set forth in the current Exhibit B.

The Contractor shall:

2.9.1 In accordance with the Test Plan, Task 2.2, the initial DERs shall be operated under the guidance of the test management control system. The DER shall be capable of operating and being controlled separately and running concurrently. The test management control system's operation shall be verified to be in compliance with the Test Plan and Test Management Control System Specification, Task 2.3. The DAS capability shall be verified to be in compliance with the Test Plan and DAS Design Document, Task 2.4.

2.9.2 Develop a Draft Commissioning Test Report. The report shall only be required for the testing of the first three DER units to be tested. Subsequent DER rotated into the test facility in accordance with the Test Plan, Task 2.2, shall not be required to be included in the Commissioning Test Report. The report shall include, but is not limited to, the following:

- What tests were conducted in accordance with the DAS Design Document, Test Management Control System Specification and Test Plan, Task 2.2
- Results of the Commissioning Tests
- Identification of any major problems and their resolution
- Photographs as appropriate

2.9.3 Submit the Draft Commissioning Test Report to the Commission Contract Manager for review and approval. The Final Commissioning Test Report shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Commissioning Test Report. Key elements from the Final Commissioning Test Report shall be included in the Final Report for this project.

2.9.4 Provide a Notification Letter regarding availability of the facility for DER Integration Testing, to the Commission Contract Manager. The letter shall include but is not limited to written documentation that the test facility is ready for testing, the date such testing shall begin, and shall include photographs.

Deliverables:

- Draft Commissioning Test Report
- Final Commissioning Test Report
- Test Facility Availability Notification Letter

Key Personnel:
None

Key Subcontractors:
Pacific Gas & Electric

Task 2.10 Modeling and Analysis

The goal of this task is to develop and validate models as testing is being performed. Those tests that lend themselves to modeling for future applications will be identified, models will be developed, and when testing takes place, the simulation runs will be compared with actual test data. Modeling of prioritized DER tests is important as it will allow subsequent test conditions to be repeated on the computer rather than having to actually setup and re-execute testing. The ability to extend the DER test results to these subsequent conditions will minimize actual testing while maximizing value of results. Furthermore, the models, as validated during testing, will be available for use in extending test results to other "real world" projects, which will likely have slightly modified configurations.

Successful completion of this task will be measured by comparing the model test results with the actual DER test result to validate the computer model structure, as set forth in the Test Plan. A

report will document the model(s) regular development and test results as well as additional ancillary testing which will take place to eliminate the need for extensive additional testing.

Meeting this goal helps to achieve the project objectives by extending the DER test results via computer simulation to consider a wide variety of distribution system configurations not used in the test system.

The Contractor shall:

2.10.1 Develop a Draft Modeling Test List. The list shall be composed of those DER Integration Tests that lend themselves to modeling for future applications such that when testing takes place, the simulation runs can be compared with actual test data.

2.10.2 Submit the Draft Modeling Test List to the Commission Contract Manager for review and approval. The Final Modeling Test List shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Modeling Test List. Key elements from the Final Modeling Test List shall be included in the Final Report for this project.

2.10.3 Develop a Draft Model Review Report. The review shall include, but is not limited to, the following:

- Key and/or unique modeling requirements and modeling packages
- Use of existing models and their capabilities
- Availability of existing models or new models as necessary
- Cost of models

2.10.4 Submit the Draft Model Review Report to the Commission Contract Manager for review and approval. The Final Model Review Report shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Model Review Report. Key elements from the Final Model Review Report shall be included in the Final Report for this project.

2.10.5 Procure the necessary modeling software and develop the models necessary to simulate the tests identified in the Final Modeling Test List.

2.10.6 Run the model simulations and validate against actual Test Plan results, as they become available.

2.10.7 Submit Draft Quarterly Modeling Reports. These reports shall include, but is not limited to, the following:

- Specific DER technologies included in model simulation
- Specific test facility configuration (e.g., variable load settings, feeder voltage control settings, feeder impedance settings, etc.)
- Operating conditions/settings of individual DERs (e.g., power levels, etc.)
- Matrix comparison of actual test values and simulated values
- Analysis, conclusions and recommendations of modeling relating to the success or failure of the results and the overall objectives of the task
- Significant issues encountered and how they were addressed

2.10.8 Submit Draft Quarterly Modeling Reports to the Commission Contract Manager for review and approval. The Final Quarterly Modeling Reports shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5

working days of receipt of the final version. Key elements from the Final Quarterly Modeling Reports shall be included in the Final Report for this project.

Deliverables:
- Draft Modeling Test List
- Final Modeling Test List
- Draft Model Review Report
- Final Model Review Report
- Draft Quarterly Modeling Reports
- Final Quarterly Modeling Reports

Key Personnel:
Bill Erdman

Key Subcontractors:
None

Task 2.11 Distributed Utility Integration Testing
The goal of this task is to conduct the prioritized DER tests and acquire data for the DER technologies identified in the technology test list for a period of six months. This task may also include up to five special tests undertaken to evaluate specific effects from the use of DERs. Typically, these special tests involve monitoring of operational scenarios and/or disturbances on the local grid and recording the response. Special tests may also address topics such as islanding, voltage/load support, harmonics, peak shaving, etc.

Successful completion of this task will be measured by the completion of the prioritized tests according to the Test Plan and the quality of the results of the tests, including the special tests if they are required, in identifying distribution system benefits and problems. Regular progress of testing activity will be updated in a monthly performance summary.

Meeting this goal helps to achieve the project objectives by providing the test results which demonstrate benefits and problems with DER on distribution systems.

The Contractor shall:

2.11.1 Develop a Microsoft Access database software tool to store and process data, download data from the DAS, and automatically screen data for consistency and validity.

2.11.2 Develop a Draft Monthly Performance Summary Format. The format shall include, but is not limited to, the following:
- Technology tested
- Number of tests attempted
- Number of tests completed
- Hours of testing
- Hours of downtime
- Summary of test results by technology

2.11.3 Submit the Draft Monthly Performance Summary Format to the Commission Contract Manager for review and approval. The Final Monthly Performance Summary Format shall be submitted to the Commission Contract Manager for written approval, which shall be provided within 5 working days of receipt of the Final Monthly Performance Summary Format. Key elements from the Final Monthly Performance Summary Format shall be included in the Final Report for this project.

2.11.4 Conduct tests and acquire data in accordance with the Test Plan, Task 2.2.

2.11.5 On a monthly basis, performance summaries of the testing shall be prepared using the Monthly Performance Summary Format and included in the Monthly Progress Reports once testing has commenced.

Deliverables:

- Draft Monthly Performance Summary Format
- Final Monthly Performance Summary Format
- Monthly Performance Summaries (shall be included in the Monthly Progress Reports)

Key Personnel:
Bill Erdman

Key Subcontractors:
None

Task 3.0 Reporting Tasks

All **public** reports shall be delivered to the Commission Accounting Office address listed on Exhibit D.

All **confidential** reports shall be sealed and marked "Confidential Deliverable" and submitted to the Contracts Officer listed on Exhibit D.

Task 3.1 Monthly Progress Reports

The objective of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this program.

The Contractor shall prepare a written Monthly Progress Report to the Commission Contract Manager by the 30th of each month, starting after contract execution and shall continue each following month until the Final Report has been accepted by the Commission Contract Manager. The Commission Contract Manager shall provide the format and content requirements for these reports. Attachment A-1 provides the format and content requirements for these reports.

Deliverables:
- Monthly Progress Reports

Key Personnel:
None

Key Subcontractors:
None

Task 3.2 Final Report

The Final Report shall be a public document. If the Contractor has obtained confidential status from the Commission and will be preparing a confidential version of the Final Report as well, the Contractor shall perform the following tasks for both the public and confidential versions of the Final Report. Attachment A-2 provides the format and content requirements.

Subtask 3.2.1 Final Report Outline

The Contractor shall:

- Prepare an outline of the Final Report describing the original purpose, approach and results of the project. The Commission Contract Manager shall provide the suggested format for this outline.

- Submit the Final Report Outline to the Commission Contract Manager for review and approval. The Final Report Outline shall be submitted to the Commission Contract Manager

within 5 working days. The Commission Contract Manager shall provide written approval within 5 working days of receipt.

Deliverables:
- Final Report Outline

Subtask 3.2.2 Draft Final Report

The Contractor shall:

- Prepare the Draft Final Report for the project. The format of the report shall follow the approved outline.

- Submit the Draft Final Report to the Commission Contract Manager for review and approval. The Commission Contract Manager will provide written comments within 20 working days of receipt. The Contractor shall revise the Draft Final Report incorporating the Commission Contract Manager's corrections and required changes. The Commission Contract Manager shall provide written approval within 5 working days.

Deliverables:
- Draft Final Report

Subtask 3.2.3 Final Report

The Contractor shall:

Submit the Final Report within 10 working days of receipt of the approval letter. The Contractor shall submit two unbound copies and one electronic copy of the Final Report to the Commission Contract Manager.

Deliverables:
- Final Report

Key Personnel:
Bill Erdman

Key Subcontractors:
Chuck Whitaker, Endecon Engineering

Task 3.3 Final Meeting

A final meeting for contract closeout will be attended by, at a minimum, the Contractor, the Commission Contract Manager and the Commission Contract Officer. The technical and administrative aspects of contract closeout will be discussed at the meeting, which may be two separate meetings at the discretion of the Commission Contract Manager.

The technical portion of the meeting shall present findings, conclusions, and recommended next steps (if any) for the project. The Commission Contract Manager will determine the appropriate meeting participants.

The administrative portion of the meeting shall be a discussion with the Commission Contract Manager and the Contracts Officer about the following contract closeout items:

- What to do with any state-owned equipment (Options)
- Need to file UCC-1 form re: Commission's interest in patented technology
- Commission's request for specific "generated" data (not already provided in contract deliverables)
- Need to document Contractor's disclosure of "subject inventions" developed under the contract
- "Surviving" contract provisions, such as repayment provisions
- Final invoicing and release of retention

Deliverables:
- Meeting participation
- Written documentation of meeting agreements and all pertinent information.

Key Personnel:
Bill Erdman

Key Subcontractors:
Chuck Whitaker, Endecon Engineering; Manny D'Albora, Pacific Gas & Electric